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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/043,265	01/14/2002	Leslie Michael Lea	WLJ.056CIP	5387

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EXAMINER	
ALEJANDRO MULERO, LUZ L	

ART UNIT	PAPER NUMBER
1763	

DATE MAILED: 03/13/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/043,265	LEA ET AL.	
	Examiner	Art Unit	
	Luz L. Alejandro	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 January 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-37* is/are pending in the application.

4a) Of the above claim(s) *12-20,22 and 24-37* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11, 21, 23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 1/11/06 has been entered.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 3, 6-7, 9-11 are rejected under 35 U.S.C. 102(b) as being anticipated by Campbell et al., U.S. Patent 4,990,229.

Campbell et al. shows the invention as claimed including a plasma processing apparatus comprising a first chamber 31 provided with a plasma inducing device 32 designed to produce a plasma in the first chamber, a second chamber 35 into which plasma so produced can diffuse to act upon a workpiece 38 being processed, and a magnetic field production device 33, 34, 36 which is separate from the plasma inducing device, wherein the magnetic field production device is positioned to act on the first

chamber either adjacent to the first chamber or between the first and second chambers. It should be noted that attenuation of the ions which diffuse into the second chamber and approach the workpiece, by directing a proportion of the ions to a loss surface of either chamber will be produced.

Regarding claims 3, 6-7, 9-11, note that the magnetic field production device 33 comprises a solenoid installed around the side wall of the first chamber, the reference discloses the magnetic field production device 34, the apparatus incorporates a ring gas feed 44 within the second chamber, below the junction point of the two chambers, in addition to a gas feed inlet 41 to the top of the first chamber, the second chamber is provided with a magnetic bucket arrangement created by an array of magnets 36 around the chamber wall; wherein the first chamber geometry is form as a cylinder, the first chamber is of annular form and the annular magnetic field production device comprises separate solenoids 33/34 located both within and around the annulus.

Claims 1, 3, 7-8 and 10 are rejected under 35 U.S.C. 102(b) as being anticipated by Maeda et al., EP 0676793 A2.

Maeda et al. shows the invention as claimed including a plasma processing apparatus comprising a first chamber 1 provided with a plasma inducing device 2 designed to produce a plasma in the first chamber, a second chamber 7 into which plasma so produced can diffuse to act upon a workpiece 20 being processed, and a magnetic field production device 5, 6, 10 which is separate from the plasma inducing device, wherein the magnetic field production device is positioned to act on the first

chamber wither adjacent to the first chamber or between the first and second chambers. It should be noted that attenuation of the ions which diffuse into the second chamber and approach the workpiece, by directing a proportion of the ions to a loss surface of either chamber will be produced.

Regarding claims 3, 7-8, 10, note that the magnetic field production device 5/6 comprises a solenoid installed around the side wall of the first chamber, the apparatus incorporates a ring gas feed 9a within the second chamber and below the junction point of the two chambers, in addition to a gas feed inlet 8 to the top of the first chamber, wherein a solenoid device is provided for the second chamber, wherein the first chamber geometry is form as a cylinder.

Claims 1, 2, and 10 are rejected under 35 U.S.C. 102(b) as being anticipated by Boswell, U.S. Patent 4,810,935

Boswell shows the invention as claimed including a plasma processing apparatus comprising a first chamber 10 provided with a plasma inducing device 32 designed to produce a plasma in the first chamber, a second chamber 20 into which plasma so produced can diffuse to act upon a workpiece 17 being processed, a magnetic field production device 13/16 which is separate from the plasma inducing device, wherein the magnetic field production device is positioned to act on the first chamber either adjacent to the first chamber or between the first and second chambers, and a gas feed inlet 19 in the top of the first chamber. It should be noted that attenuation of the ions which

diffuse into the second chamber and approach the workpiece, by directing a proportion of the ions to a loss surface of either chamber will be produced.

Regarding claims 2 and 10, note that the magnetic field production device 13 comprises an electromagnet installed around the side wall of the first chamber, wherein the first chamber geometry is form as a cylinder.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 2 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al., U.S. Patent 4,990,229 in view of Yokota, JP 7-153594.

Campbell et al. is applied as above but does not expressly discloses either the use of permanent magnets or electromagnets installed around the side wall of the first chamber or a solenoid device provided for the second chamber. Yokota discloses that permanent magnets, electromagnets and solenoids are known and suitable means that can be used for generating magnetic field in a plasma apparatus (see, for example, the abstract). Therefore, in view of this disclosure, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Campbell et al. as to use permanent magnets or electromagnets as the magnetic field production device around the side wall of the first chamber or to provide a solenoid device for the second chamber as the magnetic field production device because such magnetic field generating means are known to be equivalent and suitable for generating magnetic field.

Claims 4-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al., U.S. Patent 4,990,229 in view of Takagi, U.S. Patent 5,681,393 or Ishii, U.S. Patent 5,529,657.

Campbell et al. is applied as above but does not expressly disclose that the apparatus comprises an additional plasma inducing device at the upper region of the second chamber. Takagi discloses an apparatus in which two plasma inducing devices 521a in order to reduced the undesirable sputtering action in the discharge chamber (see fig. 20 and its description). Additionally, Ishii discloses an apparatus in which plasma inducing devices 7a/7b/7c are used to generate a high density uniform plasma

having a desired density distribution (see, for example, fig. 13 and its description). Therefore, in view of these disclosures, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Campbell et al. as to further comprise an additional plasma inducing device at the upper region of the second chamber in order to reduce the undesirable sputtering action in the discharge chamber and in order to generate a high density uniform plasma having a desired density distribution.

Claims 21 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al., U.S. Patent 4,990,229 in view of Wicker et al., U.S. Patent 5,863,376.

Campbell et al. is applied as above and further discloses that the first chamber incorporates a dielectric plasma tube, however it does not disclose that the dielectric tube is formed of aluminum nitride or silicon carbide. Wicker et al. discloses an apparatus in which a chamber comprises a high thermal conductivity dielectric material formed of aluminum nitride in order to maximize heat transfer from the antenna (see col. 6, lines 21-27). Therefore, in view of this disclosure, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Campbell et al. as to comprise a plasma tube formed of aluminum nitride because such material is known to be a high thermal conductivity dielectric material which will maximize the heat transfer from the antenna.

Claims 2 are rejected under 35 U.S.C. 103(a) as being unpatentable over Maeda et al., EP 0676793 A2 in view of Yokota, JP 7-153594.

Maeda et al. is applied as above but does not expressly discloses the use of permanent magnets or electromagnets installed around the side wall of the first chamber. Yokota discloses that permanent magnets, electromagnets and solenoids are known and suitable means that can be used for generating magnetic field in a plasma apparatus (see, for example, the abstract). Therefore, in view of this disclosure, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Maeda et al. as to use permanent magnets or electromagnets as the magnetic field production device around the side wall of the first chamber because such magnetic field generating means are known to be equivalent and suitable for generating magnetic field.

Claims 4-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Maeda et al., EP 0676793 A2 in view of Takagi, U.S. Patent 5,681,393 or Ishii, U.S. Patent 5,529,657.

Maeda et al. is applied as above but does not expressly disclose that the apparatus comprises an additional plasma inducing device at the upper region of the second chamber. Takagi discloses an apparatus in which two plasma inducing devices 521a in order to reduced the undesirable sputtering action in the discharge chamber (see fig. 20 and its description). Additionally, Ishii discloses an apparatus in which plasma inducing devices 7a/7b/7c are used to generate a high density uniform plasma

having a desired density distribution (see, for example, fig. 13 and its description). Therefore, in view of these disclosures, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Maeda et al. as to further comprise an additional plasma inducing device at the upper region of the second chamber in order to reduce the undesirable sputtering action in the discharge chamber and in order to generate a high density uniform plasma having a desired density distribution.

Claims 6, 9, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Maeda et al., EP 0676793 A2 in view of Campbell et al., U.S. Patent 4,990,229.

Maeda et al. is applied as above but does not expressly disclose that the magnetic field production device comprises a magnetic structure formed at the junction of the two chambers, the second chamber is provided with a magnetic bucket arrangement created by an array of magnets around the chamber wall, and the first chamber is of annular form and the annular magnetic field production device comprises separate permanent magnets, electromagnets or solenoids located both within and around the annulus. Campbell et al. discloses a plasma processing apparatus comprising a first chamber 31 provided with a plasma inducing device 32 designed to produce a plasma in the first chamber, a second chamber 35 into which plasma so produced can diffuse to act upon a workpiece 38 being processed, and a magnetic field production device 33, 34, 36 positioned relative to at least the first of the two chambers; wherein magnetic field production device 34 is formed at the junction of the two

chambers, the second chamber is provided with a magnetic bucket arrangement created by an array of magnets 36 around the chamber wall, and the first chamber is of annular form and the annular magnetic field production device comprises separate solenoids 33/34 located both within and around the annulus (see fig. 9 and its description). Therefore, in view of this disclosure, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Maeda et al. as to comprise the claimed magnetic field generating structure in order to provide high uniform plasma over a large area.

Claims 21 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Maeda et al., EP 0676793 A2 in view of Wicker et al., U.S. Patent 5,863,376.

Maeda et al. is applied as above and further discloses that the first chamber incorporates a dielectric plasma tube, however it does not disclose that the dielectric tube is formed of aluminum nitride or silicon carbide. Wicker et al. discloses an apparatus in which a chamber comprises a high thermal conductivity dielectric material formed of aluminum nitride in order to maximize heat transfer from the antenna (see col. 6, lines 21-27). Therefore, in view of this disclosure, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Maeda et al. as to comprise a plasma tube formed of aluminum nitride because such material is known to be a high thermal conductivity dielectric material which will maximize the heat transfer from the antenna.

Claims 3 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Boswell, U.S. Patent 4,810,935 in view of Yokota, JP 7-153594.

Boswell is applied as above but does not expressly discloses either the use of a solenoid around the first chamber or a solenoid device provided for the second chamber. Yokota discloses that permanent magnets, electromagnets and solenoids are known and suitable means that can be used for generating magnetic field in a plasma apparatus (see, for example, the abstract). Therefore, in view of this disclosure, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Boswell as to use a solenoid around the first chamber or to provide a solenoid device for the second chamber as the magnetic field production device because such magnetic field generating means are known to be equivalent and suitable for generating magnetic field.

Claims 4-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Boswell, U.S. Patent 4,810,935 in view of Takagi, U.S. Patent 5,681,393 or Ishii, U.S. Patent 5,529,657.

Boswell is applied as above but does not expressly disclose that the apparatus comprises an additional plasma inducing device at the upper region of the second chamber. Takagi discloses an apparatus in which two plasma inducing devices 521a in order to reduced the undesirable sputtering action in the discharge chamber (see fig. 20 and its description). Additionally, Ishii discloses an apparatus in which plasma inducing devices 7a/7b/7c are used to generate a high density uniform plasma having a desired

density distribution (see, for example, fig. 13 and its description). Therefore, in view of these disclosures, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Boswell as to further comprise an additional plasma inducing device at the upper region of the second chamber in order to reduce the undesirable sputtering action in the discharge chamber and in order to generate a high density uniform plasma having a desired density distribution.

Claims 6-7, 9, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Boswell, U.S. Patent 4,810,935 in view of Campbell et al., U.S. Patent 4,990,229.

Boswell is applied as above but does not expressly disclose that the magnetic field production device comprises a magnetic structure formed at the junction of the two chambers, the second chamber is provided with a magnetic bucket arrangement created by an array of magnets around the chamber wall, and the first chamber is of annular form and the annular magnetic field production device comprises separate permanent magnets, electromagnets or solenoids located both within and around the annulus. Campbell et al. discloses a plasma processing apparatus comprising a first chamber 31 provided with a plasma inducing device 32 designed to produce a plasma in the first chamber, a second chamber 35 into which plasma so produced can diffuse to act upon a workpiece 38 being processed, and a magnetic field production device 33, 34, 36 positioned relative to at least the first of the two chambers; wherein magnetic field production device 34 is formed at the junction of the two chambers; the second

chamber is provided with a magnetic bucket arrangement created by an array of magnets 36 around the chamber wall, and the first chamber is of annular form and the annular magnetic field production device comprises separate solenoids 33/34 located both within and around the annulus (see fig. 9 and its description). Therefore, in view of this disclosure, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Boswell as to comprise the claimed magnetic field generating structure in order to provide high uniform plasma over a large area.

Additionally, Boswell does not expressly disclose a ring gas feed within the second chamber, below a junction point of the two chambers. Campbell et al. further discloses the use of ring gas feed 44 within the second chamber and below a junction point of the two chambers in order to direct a uniform flow of gas towards the substrate (see col. 8-line 67 to col. 9-line 1). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Boswell as to further comprise a ring gas feed within the second chamber, below a junction point of the two chambers, in order to direct a uniform flow of gas towards the substrate.

Claims 21 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Boswell, U.S. Patent 4,810,935 in view of Wicker et al., U.S. Patent 5,863,376.

Boswell is applied as above and further discloses that the first chamber incorporates a dielectric plasma tube, however it does not disclose that the dielectric

tube is formed of aluminum nitride or silicon carbide. Wicker et al. discloses an apparatus in which a chamber comprises a high thermal conductivity dielectric material formed of aluminum nitride in order to maximize heat transfer from the antenna (see col. 6, lines 21-27). Therefore, in view of this disclosure, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Boswell as to comprise a plasma tube formed of aluminum nitride because such material is known to be a high thermal conductivity dielectric material which will maximize the heat transfer from the antenna.

Response to Arguments

Applicant's arguments filed 1/11/06 have been fully considered but they are not persuasive. Applicant argues that the apparatuses of the Campbell et al., Maeda et al., and Boswell references do not attenuate ions by directing a portion of the ions to a loss surface of either chamber. The examiner respectfully disagrees with such a statement and directs applicant to page 44, lines 7-15 of the specification of the instant invention, wherein fig. 18 is described, the apparatus of fig. 18 has a magnetic field production device 8 for attenuating ions by directing a portion of the ions to the wall. It should be noted that the structure of the magnetic field device 8 of the apparatus of Fig. 18 of the instant claimed invention is similar to at least the magnetic field production device 34 of the apparatus of Campbell et al.. Therefore, one of ordinary skill in the art at the time

the invention was made would have expected attenuation of the ions by the magnetic field production device 8 of the apparatus of the Campbell et al. reference.

Additionally, in paragraph 8 of the Lea declaration, it is stated that "The means for reducing the number of ions that reach the wafer may be an electromagnet operated from a DC power supply. The electrical current from the power supply may be set to give a chosen magnetic field strength and the level of this magnetic field strength determines the degree of reduction (attenuation) in the number of ions that reach the wafer compared to the number produced in the plasma source.". It should be noted that: a) the claims of the instant invention do not require an electromagnet operated from a DC power supply; b) a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art, if the prior art structure is capable of performing the intended use, then it meets the claim, note that the apparatuses of the Campbell et al., the Maeda et al., and Boswell references are not structurally different from the apparatus of the instant invention, as broadly claimed; and c) note that the magnetic field production devices of at least the apparatus of Boswell are electromagnets operated from a DC power supply wherein the electrical current from the power supply may be set to give a chosen magnetic field strength.

Conclusion

This is a continuation of applicant's earlier Application No. 10/043265. All claims are drawn to the same invention claimed in the earlier application and could have been

finally rejected on the grounds and art of record in the next Office action if they had been entered in the earlier application. Accordingly, **THIS ACTION IS MADE FINAL** even though it is a first action in this case. See MPEP § 706.07(b). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no, however, event will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Luz L. Alejandro whose telephone number is 571-272-1430. The examiner can normally be reached on Monday to Thursday from 7:30 to 6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Luz L. Alejandro
Primary Examiner
Art Unit 1763

March 9, 2006